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Holland

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[54] **HEATED WIPER BLADE**

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Related U.S. Application Data

[62] Division of Ser. No. 14,320, Feb. 5, 1993, Pat. No. 5,749, 118.

[51] **Int. Cl.**[6] **B60S 1/34**; B60S 1/38

[52] **U.S. Cl.** **15/250.06**; 15/250.07; 219/202; 219/505

[58] **Field of Search** ..... 15/250.06, 250.07, 15/250.08, 250.09, 250.48, 250.361; 219/202, 203, 505, 553, 510, 528; 338/22 R

[56] **References Cited**

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4,387,290	6/1983	Yasuda	15/250.07
4,497,083	2/1985	Nielsen, Jr. et al.	15/250.06
4,543,474	9/1985	Horsma et al.	219/505
4,603,451	8/1986	Van Sickle	15/250.07
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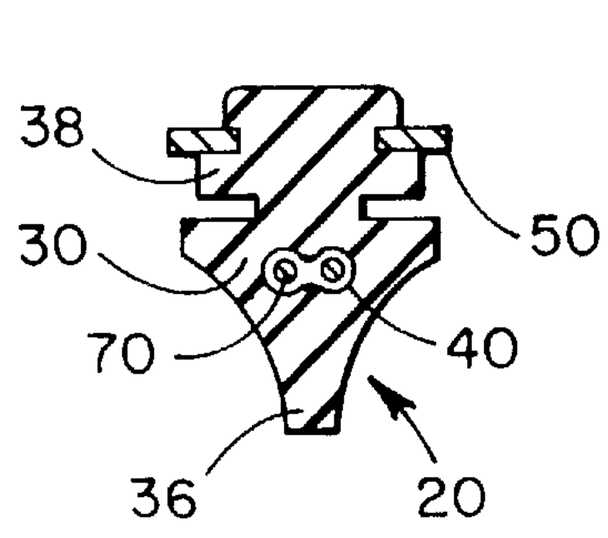
[57] **ABSTRACT**

The present invention is a heated wiper blade comprising an elongated blade and a heating element connected to the electrical system of a vehicle. The heating element utilizes a material with a positive temperature coefficient of resistance placed between a pair of conductive members. The conductive members span the length of the heating element to provide a uniform distribution of heat through the length of the blade. Electrical connections to the heating element are preferably located at one end of the blade. The heating element can be located inside the blade or between a semi-rigid attachment member and an upper surface of the blade.

3 Claims, 1 Drawing Sheet



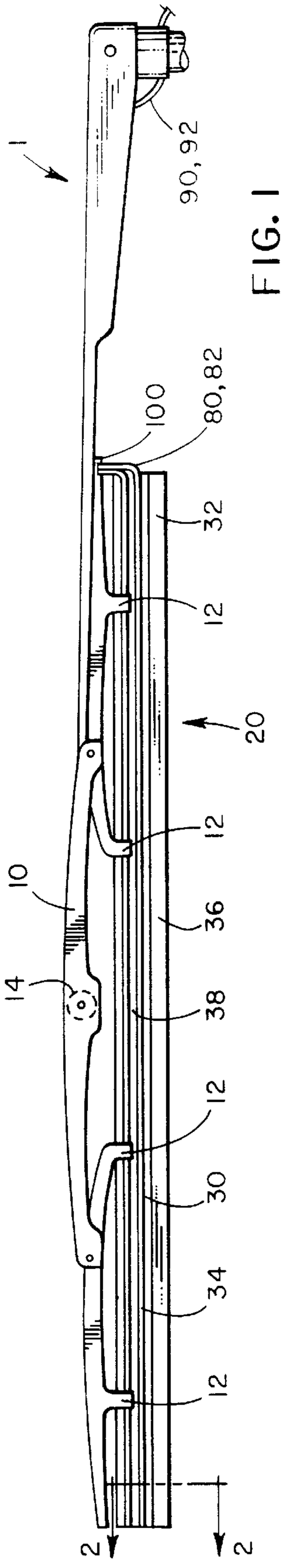


FIG. 1

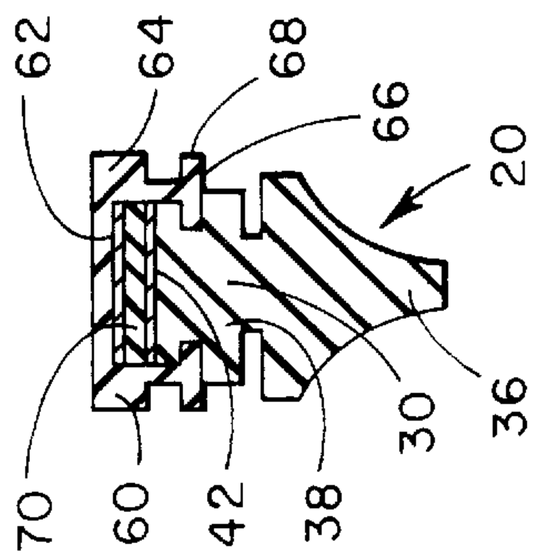


FIG. 3

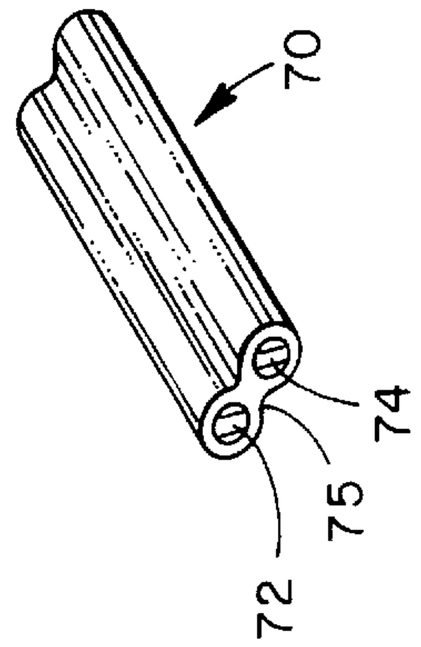


FIG. 2

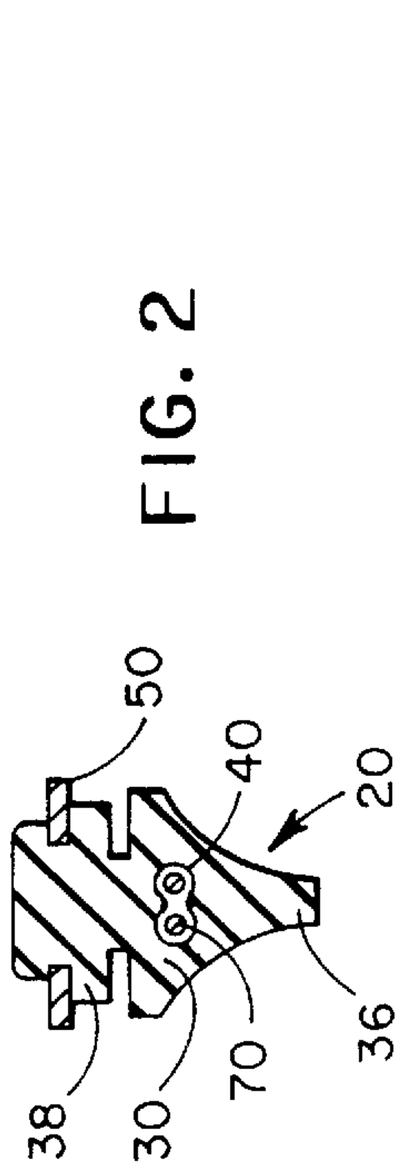


FIG. 5

FIG. 4

HEATED WIPER BLADE

This application is a division of U.S. Ser. No. 08/014,320 filed 5 Feb. 1993 now U.S. Pat. No. 5,749,118.

BACKGROUND PRIOR ART

Windshield wipers have existed since the inception of the motor vehicle. Unfortunately, as most drivers are aware, these wiper blades suffer from a variety of problems. All too often, the blades leave streaks of water across the windshield. This streaking diminishes the driver's view and produces a safety risk to everyone in or around the vehicle.

The effectiveness of windshield wipers is especially poor when temperatures go below freezing and a layer of ice, snow or slush accumulates on the windshield and the wiper blades. This layer prevents the blades from engaging the surface of the windshield and results in streaking or a complete blockage of the driver's view. This problem is enhanced when ice, snow and slush build up between the wiper blades and the windshield during operation of the wipers. In addition, when the temperature is particularly cold, the blades lose their flexibility and may not conform to the curvature of the windshield. These problems can render the wipers completely ineffective.

To overcome the above problems, the automotive industry attempted to develop a reliable and affordable device for heating the wiper blades. Several devices were developed that utilize an electrical resistor to heat the wiper blade. Examples of such devices are U.S. Pat. Nos. 4,603,451 (VanSickle); 4,387,290 (Yasuda) and 3,489,884 (Waseleski), the disclosures of which are incorporated in their entirety by reference herein.

Each of the above devices includes a means for controlling the flow of electricity to the heating element. VanSickle uses a thermostat **52** and a bimetallic thermocouple **54** to cut off electric flow when heating element **40** reaches a predetermined temperature. Yasuda uses a temperature sensor **26** positioned so that it is not affected by heating element **40**. When the ambient temperature rises beyond a predetermined value, the resistance of the sensor **26** increases to disable a relay coil **30** and cut off electrical flow to the heating element **40**. Unfortunately, these electrical components add to the price of the heated wiper and reduce its reliability as the failure of any component will render the device inoperative and may damage the blade.

Waseleski utilizes a bar shaped heating element **3** made of a material having a positive temperature coefficient (PTC) of resistivity to heat the blade. Electricity flows from electrical contact **7**, through the length of the bar **3**, and out electrical contact **9**. Although this heated wiper is not believed to be commercially available, its design is believed to be deficient in several ways. Should only a portion of the blade be covered with ice, a hot spot may develop in the bar **3** which will prematurely curtail electric flow and heat production. The thickness of the bar **3** also suggests that it will not easily bend to conform to the shape of the windshield, and a crack or discontinuity in the PTC material will curtail current flow and the production of heat over the entire length of the blade. Moreover, the relatively large amount of expensive PTC material renders the price of the heated blade unaffordable.

The present invention is provided to solve these and other problems.

SUMMARY OF THE INVENTION

The present invention is a heated wiper blade comprising an elongated blade and a heating element connected to the electrical system of a vehicle. The heating element utilizes a material with a positive temperature coefficient of resistance placed between a first and second conductive members. The conductive members span the length of the heating element and provide a consistent distribution of heat through the length of the heating element. Electrical connections to the heating element are preferably located at one end of the blade. The heating element can be located inside the blade or between a semi-rigid attachment member and an upper surface of the blade.

A primary advantage of the present invention is that it provides an economical and reliable heated wiper blade for melting snow and ice. A dramatic reduction in the cost of the blade is achieved because only a relatively small amount of PTC material is required. The heated blade is more reliable because a constant electric potential is maintained through the length of the heating element. The presence of ice on only a portion of the blade will not inadvertently curtail electric flow and heat generation. In addition, lateral cracks in the PTC material and lengthwise discontinuities in the concentration of PTC material will not cut off or inadvertently curtail the flow of electricity. The invention helps prevent streaking and smearing that can impair the safe operation of the vehicle, and is especially effective in preventing snow and ice from building up under the blade.

Another advantage of the present invention is that the heating element is flexible enough to allow the blade to smoothly conform to a curved windshield during operation. This is particularly useful on cold days when a conventional blade is prone to losing its desired flexibility.

A still further advantage of the present invention is that it is interchangeable with most commercially available wiper blades. The entire windshield wiper need not be replaced, and the heated blade can be readily connected to the electrical system of most vehicles. Additionally, a windshield wiper frame specifically designed to support the heated wiper blade, could support a conventional wiper blade as well.

Other features and advantages of the invention will be apparent from the following specification taken in conjunction with the following drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a front view showing the heated wiper blade secured to a support frame.

FIG. **2** is a sectional view of FIG. **1** taken along line **2—2** showing a wire-type heating element located inside the wiper blade.

FIG. **3** is a sectional view of FIG. **1** taken along line **2—2** showing a plate-type heating element located between an attachment member and an upper surface of the blade.

FIG. **4** is a perspective view of the wire-type heating element.

FIG. **5** is a perspective view of one plate-type heating element.

DETAILED DESCRIPTION

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and

will herein be described in detail, preferred embodiments of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the broad aspects of the invention to the embodiments illustrated and described.

The present invention generally relates to a heated wiper blade **20** for attaching to a support frame **10** of a typical windshield wiper **1**, as shown in FIG. **1**. The heated wiper blade **20** includes an elongated blade **30**, a heating element **70** and means for supplying electricity to the heating element. Although the heated wiper blade **20** is particularly suited for automobiles, it should be understood that the invention is applicable to most any vehicle, such as trucks, construction equipment, trains, sea vessels and aircraft.

FIGS. **2** and **3** show two cross sectional views of the preferred embodiments of the invention. The blade **30** is preferably shaped like a commercially available wiper blade for the purpose of interchageability. Blade **30** generally comprises a thin lower portion **36** for smoothly engaging and wiping the vehicle's windshield, and a bulkier upper portion **38** for securing a semi-rigid attachment member **50** or **60**. Blade **30** has a predetermined length roughly equal to that of the support frame **10**. Blade **30** may be any commercially available nonconductive elastic blade having the necessary flexibility for proper operating performance on a vehicle windshield such as those made of natural rubber or Noryl™.

In the first embodiment of the invention (FIG. **2**), heating element **70** is positioned inside blade **30**. A hole **40** is formed into blade **30** for snugly receiving heating element **70**. Attachment member **50** can be a standard commercially available attachment member. Inner edges of attachment member **50** fit snugly into a pair of grooves formed in blade **30**. Outer edges of attachment **80** engage frame **10** by sliding into tracks **12**.

In the second embodiment of the invention (FIG. **3**), attachment member **60** is shaped to fit over an upper surface **42** of blade **30**. Attachment member **60** has a middle portion **62** and two downwardly projecting portions **64**. Each downwardly projecting portion **64** has an inwardly projecting flange **66** for snugly engaging the blade grooves, and an outwardly projecting flange **68** for engaging support frame **10** by sliding into track **12**. Heating element **70** is snugly captured between the middle **62** of attachment member **60** and the upper surface **42** of blade **30**. Attachment member **60** may be made of any semi-rigid, nonconducting material such as a hard plastic.

As shown in FIGS. **4** and **5**, heating element **70** includes two spaced apart electrically conductive members **72** and **74** that span the approximate length of the blade **30**. A material **75** possessing a positive temperature coefficient of resistance (PTC) is secured to and between conductive members **72** and **74** so that electricity will flow between them. Conductive members **72** and **74** span substantially the length of blade **30**, and are spaced apart so that a constant electrical potential is supplied across PTC material **75** through the length of heating element **70**. Although not necessary for the operation of heating element **70**, conductive members **72** and **74** are preferably spaced a uniform distance apart through the length of blade **30**. At cold temperatures, the PTC is a good conductor and power will readily flow through both narrow and wide sections. The narrow section will heat up more quickly but the thick section will continue to conduct electricity until it heats up.

Conductive members **72** and **74** may be a pair of standard electrical wires (FIG. **4**) or a pair of conductive plates (FIG. **5**), however, it should be understood that other shapes are equally possible. Both the wire and plate designs require a relatively small amount of PTC material **75**. This reduction in PTC material dramatically reduces the cost of the heated wiper blade **20** and increases its flexibility. When conductive members **72** and **74** are wires, PTC material **75** can be applied around and between the wires prior to inserting, molding or coextruding them into the hole **40** formed in wiper blade **30**. A plate shaped heating element **70** having a thickness of approximately 0.04 inch is available through Thermacon, Inc., of 124 Westpark Road, Dayton, Ohio 45459. The exterior of heating element **70** may be painted to inhibit corrosion during use.

PTC material **75** enables the temperature of heating element **70** to be self-regulating. As the temperature of PTC material **75** increases past its Curie Point or Curie Temperature, electrical resistance increases substantially and current flow is impeded. This results in a stable top end temperature near the Curie Point of the PTC material **75**. To prevent the deterioration of wiper blade **30**, the Curie Point should be below 170° Fahrenheit, about 100°–140° Fahrenheit being preferred. Elastomeric materials exhibiting desirable PTC characteristics are preferred, however, it should be understood that any material possessing desirable PTC characteristics would be acceptable.

As shown in FIG. **1**, heating element **70** may include electrical connectors **80** and **82** for connecting conductive members **72** and **74** to wires **90** and **92** respectively. Connectors **80** and **82** preferably project out of one end **32** of blade **30** to facilitate installation, and may be formed by continuing conductive members **72** and **74** past the end **32** of blade **30** or by simply attaching additional pieces of wire to conductive members **72** and **74**. A commercially available electrical coupling **100** may also be mounted on support frame **10** near the end **32** of blade **30** to permit removal and replacement of just the heated blade **20**. Another coupling (not shown) may be provided at the top **14** of support frame **10** to facilitate removal and replacement of the entire windshield wiper **1**.

Electricity is supplied to the heating element **70** through positive and negative wires **90** and **92**. These wires **90** and **92** connect conductive members **72** and **74** to the electrical system of the vehicle. Wire **90** may be connected to the vehicle's battery or alternator (not shown), and wire **92** may be connected to a common ground for the vehicle. For example, wire **90** may be connected to the rear window defroster to enable a driver to use a defrost switch (not shown) to activate and deactivate the heated wiper blade **20**.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details shown and described herein.

I claim:

1. A wiper blade assembly capable of being heated and operating at substantially constant temperature, said wiper blade assembly comprising:

an elongated wiper blade having an attachment member connected thereto; and an elongated, flexible heating element positioned inside said wiper blade and directly contacting said wiper blade, said heating element consisting of (a) a pair of spaced apart, elongated conductive members extending substantially parallel to said wiper blade along the length of the elongated wiper blade and (b) a material with a positive temperature coefficient of resistence disposed around and in electrical contact with both of said conductive members.

2. The wiper blade assembly of claim 1 in which the elongated, flexible heating element is embedded in said wiper blade.

3. The wiper blade assembly of claim 1 which also includes means for supplying electricity to said conductive members.

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